

## INFLUENCE OF OBESITY ON MORBIDITY AND MORTALITY \*

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### INTRODUCTION

THE influence of overweight on health is by no means a new subject, but has received increasing attention in recent years. In fact, we are on the eve of the publication of a very large-scale study of mortality in relation to build and blood pressure which will cover the experience of a number of companies over the period 1935 to 1955. Unfortunately, the data of that study are not available for this meeting. Several of the more recent contributions on the subject have come from us at the Metropolitan and have provided new and original data. In this presentation I shall cite, insofar as possible, the latest studies that are pertinent, although many of the good and fundamental investigations in the field are not new and cannot be ignored in any consideration of the subject.

I shall put repeated stress on the relationship of obesity to diseases of the heart and circulatory system. This is warranted by the increasing dominance of these conditions as causes of chronic illness and death. Consider, for example, that last year 55 per cent of the more than one-half billion dollars paid out in death claims by the Metropolitan was accounted for by deaths from cardiovascular-renal diseases. Only 20 years before, the proportion was 43 per cent. Consider also that for white men at age 25, the chances of dying from one of these diseases before age 65 are 16 in 100, out of the total for deaths from all causes of 31 in 100<sup>1</sup>.

How do we identify the obese or the overweight? The latter is the term that we much prefer to use. Various measures have been proposed, but for practical purposes in analyzing data on large groups of people, we and others have had to depend, for the most part, on an arbitrary

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definition based upon deviations from average weight for height, age and sex. Admittedly, this leaves much to be desired, but the range of weights and classifications used in our studies is great enough to differentiate the thin, the obese, and various weight subdivisions in between. Until other rapid and reproducible measures are devised, these simple height-weight criteria will continue to serve the purpose.

The available data on the influence or association between body weight and morbidity and mortality are generally in good agreement. The mortality data are far more abundant, more comprehensive, and in many ways, more satisfactory than those on morbidity. Useful data on the relationship of weight to morbidity are largely restricted to those on chronic disorders. The relationship of weight to acute and short-term disorders is rather obscure because their incidence varies so widely and is influenced by so many factors that any effect of weight *per se* would be difficult to isolate and evaluate even if the necessary basic records were available. Moreover, industrial absenteeism records, which form the basis of many morbidity studies, show that a very large part of the short-term absences from work, allegedly due to illness, are ascribed to acute respiratory and digestive disorders and accidents.

#### LIFE INSURANCE STUDIES OF MORTALITY IN RELATION TO BODY BUILD

Accordingly, I shall present first the pertinent facts from mortality studies. As is well known, they are derived from life insurance experience. The data for them have been collected over a longer period of years and have been periodically analyzed. The volume of data is large and amenable to accurate evaluation. The studies are designed to measure long-range effects. The aim of these studies is by no means academic. It is to determine which groups, if any, classified by build, show sufficient excess of mortality to warrant the charging of extra premiums. This is in accord with insurance practice and policy to assign an equitable rating to each applicant for insurance. Life insurance is a highly competitive business. Comparative costs are closely related to the proper selection and rating of applicants to produce a satisfactory mortality rate in the various classifications of risks. Thus, the attitude of insurance companies with respect to the build of individuals is quite objective.

We may briefly consider the nature and characteristics of the data in these life insurance studies. Applicants are classified either according

to absolute or per cent deviations from average weight for height and age. The initial selection of cases and the subsequent evaluation are entirely independent. The evaluation is based on detailed comparisons of the mortality in each weight classification with the contemporaneous mortality experience on all standard insured risks, i.e., those insured at regular premium rates. These studies generally relate to presumably healthy persons, selected for insurance after medical examination. These persons are in better than average economic circumstances, are free of serious defects and are engaged in safe occupations. In this way major extraneous factors which could influence the results are avoided. Obviously, the cases included in these studies do not represent a cross-section of the population, but are comparable with the standard risks against whom they are measured. To the extent that more serious impairments are more common in overweight persons than in those of lesser weight, the results understate relatively the mortality associated with overweight.

Life insurance studies of mortality in relation to build include three joint investigations<sup>2</sup> to which a number of companies contributed data, and an even larger number of studies by individual companies on their own experience<sup>3</sup>. The first of these studies goes back to the beginning of the century; the latest are concerned with the past decade. While there are differences in detail, the results are consistent in showing that overweight of even moderate degree—say 10 to 20 per cent—is associated with a significant elevation of mortality and that the amount of excess mortality increases with the degree of overweight. Moreover, while in the earlier studies a moderate degree of overweight was found to be advantageous in younger persons, this is no longer true because the disadvantage of underweight existing heretofore has been virtually eliminated as a result of the huge reduction in mortality from tuberculosis and pneumonia, which then were primarily responsible for the high mortality among young underweights.

The many studies are likewise consistent with regard to the causes of death which account for the adverse record of overweights. All of them showed that this is due primarily to excessive death rates from diseases of the heart and circulatory system, diabetes and biliary tract disease. These conditions, and especially heart and circulatory disorders, have come to account for an increasing proportion of total deaths as a result of the decline in the infectious diseases. Accordingly,

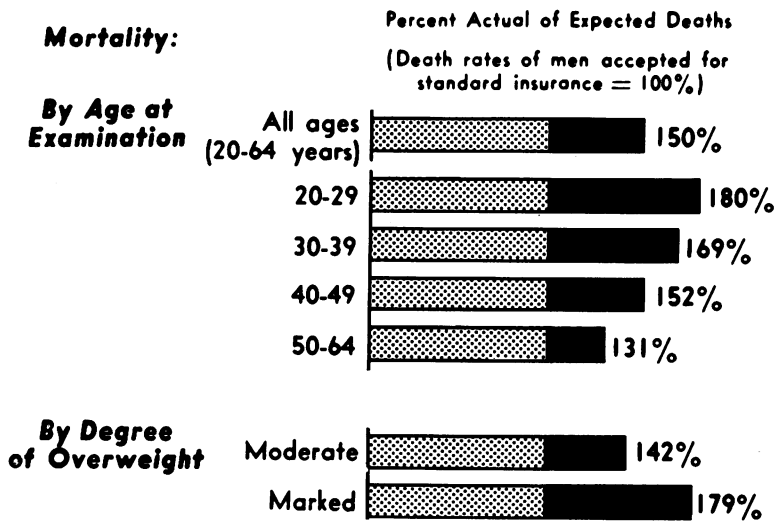


Fig. 1.—Mortality of men rated for overweight.  
Experience of Metropolitan Life Insurance Company.  
Substandard Ordinary Issues, 1925-1934, traced to 1950.

the disadvantage of the overweight as compared with lighter weight groups is relatively more marked than ever before.

Because the general trends in all of these studies are so much alike, it will suffice to show facts from the latest study only<sup>3a</sup>. This was made by the Metropolitan Life Insurance Company and was limited to those applicants accepted for insurance who were charged higher premium rates solely because of their overweight. It covers about 26,000 policies on male lives and 25,000 policies on female lives between ages 20 and 64 issued between 1925 and 1934 and traced to the policy anniversary in 1950. As is customary in life insurance studies, results are reported in terms of the percentage ratio of actual to expected deaths, the expected deaths being computed on the basis of contemporaneous experience among standard risks. I would interject a word of caution about the interpretation of these figures. A ratio of 200 per cent, or double the expected mortality, does not mean a reduction of one-half in the average length of life of a group with such an unfavorable experience. The two measures have no simple and direct relationship. The high ratios do reflect a moderate but often preventable curtailment of longevity, varying according to the degree of excess mortality and other factors.

Figure 1 shows the facts for men, classified according to the age at

TABLE I—MORTALITY AMONG MALES LIMITED TO SUBSTANDARD INSURANCE BECAUSE OF OVERWEIGHT

Observed ratios of actual to expected deaths and estimated ratios on basis of mortality in "optimal weight" group  
Experience of Metropolitan Life Insurance Company, Ordinary Department, issues of 1925—1934, traced to policy anniversary in 1950

<i>Age Group at Issue</i>	<i>Per Cent Actual of Expected Deaths Estimated on basis of mortality in "optimal weight" group*</i>	
	<i>Observed</i>	
20—29	180	194
30—39	169	201
40—49	152	197
50—59	131	166

\* According to ratios in weight group with lowest mortality in *Medical Impairment Study, 1929*—Ages 20-29—93%; 30-39—84%; 40-49—77% and 50-59—79%. (Ref. 2c, p. 38)

examination for insurance, and by degree of overweight. For the latter, the cases were classified according to our rating standard, which is not based upon absolute or relative amount of overweight. The moderate overweight among the males in the study would average 30 to 35 per cent overweight and among the females 35 to 40 per cent overweight; the marked overweight group would average 10 to 15 per cent higher. It is clear that in all the categories shown, the mortality is significantly elevated. Proportionately, the record among males is worse at the younger than at the older ages at issue. Those who are most overweight show the greatest excess in mortality.

The situation among the overweight women is the same, in major respects, but differs in certain details, e.g., that the relative mortality by age shows no particular trend.

A more rigorous measure of the excess mortality among these overweights is to compare them with weight groups showing the lowest mortality. For this purpose contemporaneous data are not available, but we have made computations, using the mortality in the "optimal weight" class in the *Medical Impairment Study, 1929*, as a standard. These computations are shown in Table I. On this basis, the mortality ratios among the overweights in this study are of the order of 200 per cent in age groups up to 50, and 165 per cent for those aged 50 to 59 at entry.

Table II shows the relative mortality from principal causes of death

TABLE II—PRINCIPAL CAUSES OF DEATH AMONG MEN AND WOMEN  
RATED FOR OVERWEIGHT

CAUSE OF DEATH ( <i>Death Rates of Persons Accepted for Standard Insurance = 100%</i> )	MEN <i>Per Cent Actual of Expected Deaths</i>	WOMEN <i>Per Cent Actual of Expected Deaths</i>
Principal cardiovascular-renal diseases	149	177
Diabetes mellitus	383	372
Cirrhosis of the Liver	249	147
Appendicitis	223	195
Biliary calculi (gallstones)	206	284
Cancer—all forms	97	100
Leukemia and Hodgkin's disease	100	110
Tuberculosis—all forms	21	35
Pneumonia—all forms	102	129
Ulcers of stomach and duodenum	67	*
Suicide	78	73
Accidents—total	111	135

\* Deaths too few to warrant calculation of mortality ratio.

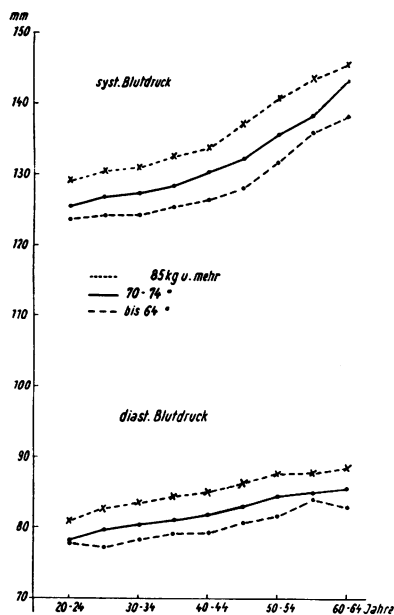
Note: Italics denote that the deviation from the Standard is not statistically significant.

Experience of Metropolitan Life Insurance Company. *Substandard Ordinary Issues*, 1925-1934, traced to 1950.

among men and women. This part of the analysis is limited to attained ages 25 to 74. First, attention should be given to the facts for the heart and circulatory disorders because of their outstanding position in the total mortality picture. Among males, the death rate from this group of causes was about one and a half times that among male standard risks, and among females, it was about one and three-quarters times that of female standard risks. Diabetes shows the largest relative excess mortality among the major causes, with a death rate about four times as high as that of standard risks among both men and women. The mortality from cirrhosis of the liver, gall stones and appendicitis was double or more that of standard risks among males and was excessively high among females also. It is notable that although the mortality from cancer in the aggregate was not elevated, the mortality from cancer of the biliary tract was significantly in excess of the expected.

#### RELATIVE FREQUENCY OF IMPAIRMENTS AMONG OVERWEIGHTS

Studies of the association of overweight with morbidity and impairments are quite numerous but are so heterogeneous in character that it is often not possible to make direct comparisons between them, and



Experience of German Life Insurance Companies, 1955-1956 (Döring)

Fig. 2—Average blood pressure of men, 170-174 cm. tall, in relation to weight and age.

one must be content to ascertain what general tendencies they reveal. These studies differ with respect to the nature and composition of the populations they cover, the duration of observation and the methods of analyzing the data. They are primarily cross-section studies, and in some cases it may be suspected that the weight at the time of observation may not be the usual weight of the individual, and weight reduction has been a part of the treatment he has undergone. This would, of course, primarily affect persons who had previously been overweight. Other biases, often unknown, may exist in the populations studied. Nevertheless, there is a high correlation between the findings in these studies and those in the mortality investigations.

There are numerous studies from widely different sources which show a definite rise in the mean blood pressure levels with increasing weight. I shall cite a few of them, some quite recent. The first large-scale study<sup>4</sup> based upon insurance data was made in this country in 1924 on persons accepted for life insurance, most of them in the decade preceding 1924. Among men between ages 28 and 42, for example, the

mean systolic pressure for those more than 25 per cent overweight was about 7 mm. greater than for those more than 25 per cent underweight. For the diastolic pressure the difference in the means between the two weight groups was about 6 mm.

The recent experience of German life insurance companies is illustrated in Figure 2, and the same characteristics are clearly revealed<sup>5</sup>. The material is based on men 170 to 174 cm. tall, and the averages are given for three weight groups: under 64 kg., 70 to 74 kg., and 85 kg. and over. In every age group the mean figures are lowest for the lighter weight men and highest in the heavier weight group. This applies to the means for both the systolic and diastolic readings.

A study of blood pressure readings on industrial workers collected about 15 years ago showed the same trends<sup>6</sup>. For example, at ages 40 to 44, the mean systolic pressure among men 25 per cent or more overweight was 6 mm. higher than the mean of those 10 per cent or more underweight, and the difference in the mean diastolic pressure was also 6 mm. Even larger differences were found in the case of women, about 14 mm. in the mean systolic pressure and 10 mm. in the diastolic pressure.

A similar study made in Norway on persons examined by plant physicians in 1952 also displayed the same general tendency<sup>7</sup>. The samples for women in some age groups were relatively small, and accordingly, the averages in some detailed weight groups were based on relatively small numbers. At ages 40 to 49 the mean systolic pressure for men 20 per cent or more overweight was 9 mm. greater than for those 20 per cent or more underweight; for women in this age group the difference was 15 mm. The corresponding difference in the mean diastolic blood pressures was about 8 mm. for men and 13 mm. for women.

Another study made in the adult population of two parishes of the city of Bergen, Norway<sup>8</sup>, in which the great majority of the population was examined, showed the same general tendency, but this was much less marked than in the other studies. The mean blood pressures for the obese, however, were significantly higher than for persons of lesser weight.

Even in India, according to a recently published study made in Delhi, the blood pressure was found to increase with body weight<sup>9</sup>. Among the men, the data on whom were reported separately for a

rural and an industrial population group and the high socio-economic class, and among women in the rural population, the blood pressure levels, both systolic and diastolic, tended to rise with increase in weight. The number of cases in the various groups was, however, not very large. The association of elevated blood pressure with overweight is found also in the study, quite different in nature, made on Army officers by Levy and his associates<sup>10</sup>. This study was based on long-term follow-up of persons not hypertensive at first observation. Sustained hypertension developed in officers who were overweight at a rate two and a half times as high as in those not overweight.

The recent study by Master and his associates<sup>11</sup> on blood pressure in the elderly shows also that the mean blood pressure readings among the overweights were consistently higher than among middle weight and thin people. This situation prevailed in all groups up to age 80.

The association of overweight with heart disease has been investigated in many studies of different types. Of particular interest are a number of long-range studies which have been started in the last few years in a few communities. The populations covered in these studies are not very large, the periods of observation still rather short and the effects of various biases in the selection of the cases are not known precisely. Time does not permit review of these matters. Nevertheless, the preliminary results are worthy of attention. These studies are concerned with assaying the importance of various factors in the development of heart disease in those who at initial observation had no evidence of heart disease. To date, the most consistent finding is the association of overweight. The study in Framingham<sup>12</sup> is probably best known. There, in the four-year period of follow-up of men between ages 45 and 62, those who were appreciably overweight showed double the frequency of new cases of arteriosclerotic heart disease than those who weighed less.

In Albany, New York, in a study based upon State Civil Service employees 39 through 55 years of age, the incidence of new cases of ischemic heart disease was three times as high in the small group of men 40 per cent or more above ideal weight than in the group as a whole<sup>13</sup>. The incidence is, as yet, little elevated in the intermediate overweight group. A study of Los Angeles Civil Service male employees between ages 40 and 70 has not produced particularly clear-cut results, although the frequency of coronary disease has been higher in the heavy weight

than in the light weight group<sup>14</sup>.

The frequency of overweight among cardiac patients seen in private practice was reported by Master and his associates<sup>15</sup>. Among male patients the proportion of overweights was nearly 40 per cent in patients with angina pectoris, coronary insufficiency and hypertension, and nearly 50 per cent in those with coronary occlusion, as compared with approximately 20 per cent in the population used as a control. The findings in females were less clear-cut, but underweight was distinctly less frequent than would be expected among the patients with coronary insufficiency and hypertension.

A further illustration is taken from the intensive morbidity survey made in the Eastern Health District of Baltimore<sup>16</sup>. A special aspect of this was the association of various chronic diseases with overweight. Among patients with coronary disease there was a significantly high proportion of overweights among persons with heart disease.

Diabetes is perhaps the classic illustration of the association of overweight with disease, especially in the type of diabetes occurring in middle life and old age. The great majority of the patients are, or have been, seriously overweight, and a very high percentage truly obese. To take examples from recent studies, I may refer first to the data on 90 industrial workers<sup>17</sup>. Of these, nearly 50 per cent were 20 per cent or more overweight at the time of diagnosis. If the weight before onset were used, the proportion would be appreciably greater. In a recent study in a German clinic<sup>18</sup>, 53 per cent of the patients were appreciably overweight according to the standard used.\*

The high mortality from liver disorders in the studies of insured overweights is paralleled by their high incidence in clinical experience. A recent study<sup>19</sup> of 20 hospitalized men who were 50 per cent over ideal weight, with no illness involving or likely to involve the liver, showed that six of them had enlarged livers, five had enlarged spleens and four of these had both conditions. Nine of them had impaired glucose tolerance. Moreover, liver function tests were frequently abnormal. In another study of 18 obese patients in a Veterans Administration Hospital, a significant proportion were found to have abnormal liver function tests and a great many had elevated blood sugars on a glucose tolerance test<sup>20</sup>.

Gall-bladder disorders also find more victims among overweights

\* More than 10 kg. plus height in cm. over 100 expressed in kg.

than among average and underweight persons. This is documented in our insurance experience<sup>21</sup>, in the Eastern Health District Study for Baltimore<sup>16</sup> and in an autopsy study at the Mayo Clinic reported by Mentzer<sup>22</sup>.

Impairment of pulmonary function in the obese has been the subject of a number of studies, and it will suffice to mention only one recent report<sup>23</sup>. This covered 28 patients who were 100 pounds or more above ideal weight; 15 of them had abnormally low arterial oxygen saturation and 10 of these cases had lung disease. Distinct improvement in the condition was noted when weight was reduced. Even in 13 cases where the arterial oxygen saturation was within normal limits, respiratory reserve volume and mean maximal breath capacity was reduced, but tended to return to normal values in patients who reduced their weight.

Wear and tear on the joints in the body is hastened in some degree by excessive weight. Accordingly, osteoarthritis occurs at a higher rate among overweights than among persons of lesser weight. This is borne out by data from periodic health examinations<sup>24</sup> and by the records of the Eastern Health District Study<sup>16</sup> to which reference has been previously made.

Malignancy of the genital organs, and more especially of the endometrium occurs at a higher rate among overweight women than among those of average weight or less. Several studies have brought this out, notably those by Hertig and his colleagues in the Boston area<sup>25</sup>. Available morbidity data show no other special association of overweight with malignancy, but as already noted, malignancy of the biliary tract is found to be elevated among overweights in the mortality study of insured risks.

Other conditions or symptoms for which there is evidence of greater frequency among overweights than among others include hernia<sup>26</sup>, cerebral vascular accidents, peripheral vascular disease<sup>27</sup>, and various urinary impairments<sup>28</sup>.

#### EFFECT OF OVERWEIGHT ON PROGNOSIS IN VARIOUS DISORDERS

As if it were not enough that overweights are prone to acquire so many impairments and disabilities from so many conditions, especially from serious disorders of middle and later life, the outlook for impaired overweights is usually less favorable than for impaired persons who are not overweight.

The combination of moderate overweight and even slight elevation of blood pressure brings an appreciable increase in the death rate from heart disease. A recent study among persons insured in the Metropolitan Life Insurance Company disclosed a death rate in this group more than double that among standard risks, with arteriosclerotic heart disease being responsible for most of the excess mortality. In cases with a moderate elevation of blood pressure, the mortality from heart disease was even higher. In the Framingham study likewise, the combination of overweight and hypertension was found to have a greater adverse effect on the incidence of arteriosclerotic heart disease than either factor alone. Again, in the study of Army officers by Levy and his associates<sup>10</sup>, the overweights with a history of transient hypertension and tachycardia developed sustained hypertension at a rate one and a half times as high as in those not overweight.

Our insurance studies have disclosed several other groups in whom overweight is an adverse factor, as shown by the excess in mortality among impaired overweights with such conditions as asthma<sup>29</sup>, bronchitis<sup>30</sup>, albuminuria<sup>31</sup>, and high blood sugar<sup>32</sup>.

The overweight surgical patient apparently offers special problems both to the anesthesiologist and the surgeon, although what this means in terms of extra morbidity or mortality has not been well documented. Schwartz has recently summarized these problems from the point of view of the anesthesiologist<sup>33</sup>. He cites difficulties in maintaining a free airway, inadequate respiratory exchange, longer induction and recovery periods, and need for greater muscular relaxation. He also refers to the problems arising from the more frequent occurrence in overweights of cardiovascular disease, diabetes and abnormal liver function. Specific evidence of surgical problems in overweights is the increased frequency among them of postoperative embolism and thrombosis. Barker and his associates<sup>34</sup> reported that in female patients weighing over 200 pounds who underwent abdominal hysterectomy or intestinal operations, this occurred at about double the rate found in those women undergoing the same operative procedures who weighed less than 200 pounds.

The overweight woman runs extra risk from pregnancy, and her chances of bearing a live and healthy child are diminished, especially if she has been in difficulty in a previous pregnancy. Thus, a number of studies all indicate a higher frequency of complications during pregnancy and delivery and an increase in both maternal and fetal mortality<sup>35</sup>.

PER CENT ACTUAL OF EXPECTED DEATHS  
(Death rates of persons accepted for Standard Insurance = 100 per cent)

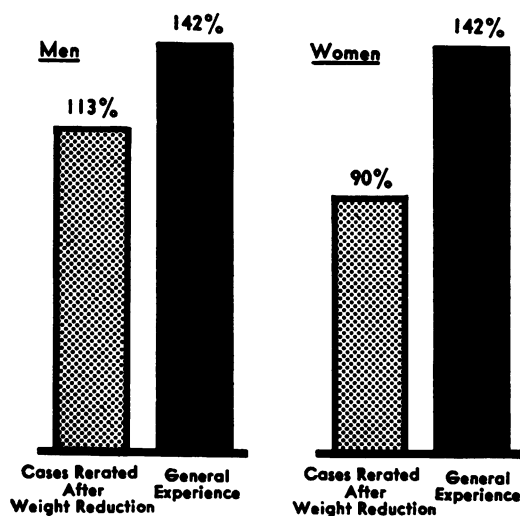


Fig. 3—Effect of weight reduction on mortality. Experience on persons rated for moderate obesity who received lower ratings after weight reduction compared with general experience on cases rated for moderate obesity.

Experience of Metropolitan Life Insurance Company.  
Substandard Ordinary Issues. 1925-1934, traced to 1950.

More overweight women tend to have large babies than other mothers and a relatively high proportion of them eventually develop diabetes<sup>36</sup>. In women with a history of eclampsia, toxemia developed in a subsequent pregnancy in 75 per cent of the overweight women, as compared with 26 per cent in women of light build, according to a study by Chesley and his associates<sup>37</sup>.

#### EFFECTS OF WEIGHT REDUCTION ON MORTALITY AND PROGNOSIS IN OVERWEIGHTS

The question then naturally arises: What benefits ensue to overweights if they reduce? There is evidence that weight reduction brings improved health and longevity to many, although comprehensive and long-term measures of this result are difficult to obtain. The best overall evidence to date has been derived from the study of persons in the Metropolitan Life Insurance Company who were rated, i.e., charged extra premiums, merely because they were so much overweight<sup>3a</sup>. A group of cases in this study were identified who later reduced their

weight and maintained it sufficiently long so that the rating was removed. The experience on these cases is shown in Figure 3. In this group of both men and women, the mortality was substantially less than in the general experience among overweights. The rate of decline in mortality from cardiovascular diseases was apparently as great as that from all causes, although we could not determine this exactly.

A number of scattered studies based upon clinical experience show the benefit of weight reduction in various conditions. Weight reduction is now an orthodox part of the treatment of hypertension, and several studies have shown a lowering of blood pressure following weight reduction. This matter was carefully re-investigated recently by Martin<sup>38</sup> in England, in a series of 37 obese patients of whom 18 had normal blood pressures and 19 had hypertension. These patients did not suffer from chronic nephritis, malignant hypertension or valvular heart disease. They had remained on a reducing diet and had lost at least 14 pounds during a period of observation of at least six months. The reduction in blood pressure was considered significant only if it reached or exceeded 20 mm. in the systolic level or 15 mm. in the diastolic level. By this criterion, significant lowering of systolic pressures among the hypertensives was obtained in five of the 19 hypertensive cases, and in two patients both systolic and diastolic levels were reduced. In the 18 cases with normal blood pressure, the systolic pressure was lowered in three and both levels were lowered in one additional case. While this response is not extraordinary, the author concluded that the occasional successes obtained, coupled with the subjective improvement in the majority of cases, justified the continuance of weight reduction as a routine measure in obese hypertensive patients, and that benefit was also obtained by lowered demands made on the heart in these hypertensive cases.

Another illustration is the finding, reported by Lups and Francke<sup>39</sup>, that during the period of starvation in wartime Holland (September 1944 to May 1945), a reduction in blood pressure frequently occurred in association with weight loss, especially in hypertensive patients.

Treatment of the overweight cardiac patient includes weight reduction but, to my knowledge, no studies have been made of the long-term prognosis in obese cardiacs who have successfully reduced as compared with those who have not. The purpose and value of weight reduction would seem to lie in cutting down on the amount of work performed

by the heart in these patients. Obviously, however, body weight is only one factor in the prognosis of the cardiac patient.

Middle-aged overweight diabetics have shown a return to normal glucose tolerance with reduction in weight. Newburgh<sup>40</sup> demonstrated that where the weight was brought down to the normal level, normal glucose tolerance was restored in nearly 75 per cent of the cases, and improved tolerance was observed in half the remaining cases, as well as in some patients with lesser degrees of weight reduction. Osserman and Dolger<sup>41</sup> obtained roughly comparable results with obese diabetics whose weight was reduced.

A recent study by Goodman of 135 elderly obese patients in a Cleveland Nursing Home in whom diabetes, gangrene, congestive heart failure and cerebral vascular accidents were in excess of the expected number showed that beneficial results were always seen with weight reduction<sup>27</sup>. In 75 per cent of these patients the blood pressure was above 150/90, and the blood pressure levels almost invariably fell with weight reduction.

#### SUMMARY

We may briefly summarize by pointing out that a wide variety of data from many different sources indicates that overweight impairs both health and longevity. It is associated with an increased frequency of many serious disorders, most important of which are those involving the heart and circulation. These are precisely the conditions which today are responsible for a majority of all deaths and probably even of premature deaths. Overweights in whom serious disorders have developed do not live as long as thinner people similarly impaired. Nevertheless, some improvement in the prognosis for overweights with serious disorders may be achieved by weight reduction.

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*Addendum*—The new study on mortality according to build to which reference was made has since been completed and published (Build and Blood Pressure Study, Society of Actuaries, Chicago, 1959). As in earlier studies, the mortality of overweights exceeds that of lighter weight persons and increases with degree of overweight. The major difference between the new and the earlier studies is that the mortality rate of overweights has become higher in comparison with that of underweights. The former disadvantage of underweights, especially at the younger ages, due to their high mortality from tuberculosis and pneumonia, has been virtually eliminated by the radical reduction in mortality from these diseases. In contrast, cardiovascular diseases, from which overweights experience above-average mortality, have steadily increased in proportion to the total mortality and now account for a majority of the total.

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